Case report

UDC: 616-001-089.84
doi:10.5633/amm.2015.0114

USE OF VACUUM-ASSISTED CLOSURE (VAC) IN COMPLICATED PERINEAL WOUNDS: ANALYSIS OF CASES

Blaž Trotovšek[1], Danijela Semenič[2]

University Medical Centre, Department of Abdominal Surgery, Ljubljana, Slovenia[1]
University Medical Centre, Department of Surgical Infections, Ljubljana, Slovenia[2]

Treatment of perineal wounds has been one of the challenges of surgery since its inception. Vacuum-assisted closure provides a new option that can be used in concert with a wide variety of standard existing surgical techniques. It was originally developed for treatment of chronic wounds in patients with diabetes. It has rapidly evolved into a widely accepted treatment also for acute, contaminated and complicated wounds from failed operations. User-friendliness of the technique and a high rate of success have promoted its use in all surgical specialties. One of the greatest achievements of modified technique is undoubtedly improvement in the treatment of open abdomen. Use of vacuum-assisted closure techniques in large contaminated abdominal and perineal wounds even in the presence of the artificial material like meshes has gained widespread acceptance among surgeons. Creative surgeons continue to regularly adapt the technique to difficult clinical problems. Perineal wounds present a special challenge. The vacuum-assisted closure device allows earlier wound closure, early skin grafting and hospital discharge. Its use in the perineum presents a challenge, but with proper application, even the most complex perineal wounds can be healed. We present four cases of complex perineal wounds in which the vacuum-assisted closure device was used. In experienced surgical hands, it greatly enhances the scope and safety of wound treatment. *Acta Medica Medianae 2015;54(1):81-86.*

***Key words**: perineal wounds, vacuum-assisted closure, negative pressure wound therapy, wound healing, surgical technique*

Contact: Blaž Trotovšek
Department of Abdominal Surgery
University Medical Centre
Zaloška 7, 1000 Ljubljana, Slovenia
E-mail: blaz.trotovsek@kclj.si

Introduction

Perineal wounds present a special challenge for treatment. Vacuum-assisted closure (VAC) is a promising approach for the management of complex abdominal and perineal wounds. We present theoretical basis and cases of complicated perineal wounds in which the VAC was used.

The vacuum-assisted closure device (VAC, KCI, Inc., San Antonio, Texas, USA) has in many ways revolutionized wound care. It can be used on almost any part of the body to improve the wound healing, granulation, and decrease the time burden of wound care specialists. Perineal wounds are complex. It is often difficult to keep a dressing in place. Anatomic characteristics with presence of natural orifices of urethra and anus add to the complexity of wound management in this region. Perineal wounds are also often the result of poor healing secondary to radiation therapy for pelvic malignancies. As such, the VAC device has significant utility in overcoming these issues.

The VAC device and different dressings increase the deposition of granulation tissue with stimulation of angiogenesis, removes exudates, securely covers the wound, reduces bacterial contamination and thus decreases the time to wound healing (1).The VAC system allows earlier wound closure, early skin grafting with improved graft adherence, earlier hospital discharge, and earlier return to baseline functional status. Its use in the perineum presents a challenge, but with proper application, even the most complex perineal wounds can be healed (2). Multiple factors affect the healing of perineal wounds. In addition to ensuring adequate nutrition, prevention of excessive pressure, redirection of urinary and fecal flow, appropriate debridement, the healing of wounds in the perineum still present multiple challenges (3). High energy pelvic trauma, Fournier gangrene or necrotizing fasciitis and mesh infection in prosthetic repair are only few of the conditions where VAC can improve patient's outcome or even can save his/her life.

Pelvic fractures with critical soft tissue conditions are usually the result of high-energy

trauma. Open pelvic fractures are rare and amount to 2–4% of all pelvic fractures only. The high mortality of open pelvic injuries is due to two complications: in the early phase, the patient is endangered by exsanguination and in the following course the sepsis determines the lethal outcome (4). Open fractures require early aggressive debridement of the soft tissues followed by skeletal stabilization. Temporary wound dressings should remain in place until definitive

soft-tissue coverage is obtained. Definitive soft-tissue closure will be expedited by serial debridements (5). The use of VAC as a temporary wound dressing in open fracture situations, in patients whose general condition is often severely compromised, was described as a method for bridging till definitive care of the wound (6).

Fournier gangrene is a rare but highly infectious disease characterized by fulminant necrotizing fasciitis involving the genital and perineal regions. (7) The pathology was first described in 1883 by Jean Alfred Fournier who presented five male diabetic patients with fulminating gangrene of the genitalia (8). It is a synergistic infection caused by a mixture of aerobic and anaerobic organisms and predisposing factors, including diabetes mellitus, alcoholism, malnutrition, and low socioeconomic status. Fournier's gangrene is caused by normal skin commensals of the perineum and genitalia that act synergistically to cause infection and invade the tissue, causing microthrombosis of the small subcutaneous vessels leading to ischemia. Various cytotoxic agents, collagenases, streptokinases and others are released at the site of gangrene and cause the progressive destruction of local tissue. Therefore, good management is based on aggres-sive debridement, broad-spectrum antibiotic therapy, and intensive supportive care (9). VAC is a widely adopted technique in many clinical settings. Nevertheless, its application and effect in the treatment of Fournier gangrene are still unclear although the results in treatment of necrotizing fasciitis are promising (7).

Deep surgical site infection following mesh graft repair of inguinal or incisional hernia is a serious challenge for both patients and surgeons. Most authors recommend removal of the infected mesh if the infection cannot be resolved by conservative means and/or antibiotic therapy. However, mesh removal often results in hernia recurrence, necessitating subsequent surgical procedures such as autologous flap reconstruction or another mesh graft implantation after the infection has resolved. Therefore, salvage of the infected mesh graft without surgical removal is desired. Only a few publications described mesh graft-preserving treatment by conservative means and VAC applications. With use of VAC, up to 92% mesh infections were cured depending mostly on the type of mesh used (10).

Methods

We have been using the VAC system (KCI, Inc., San Antonio, Texas, USA) for the treatment of complex perineal wounds since 2002, and VAC ULTA system (KCI, Inc., San Antonio, Texas, USA) since 2012. The VAC system consisted of polyurethane soft sponge cut to fit the wound and placed into the cavity and of a transparent occlusive gas- and fluid-impermeable plastic film applied over the foam to create an airtight seal. A hole of 2cm in diameter was cut into the film in the middle of the foam. A TRAC pad was embedded over the hole and attached to an adjustable vacuum pump by means of a suction tube. A continuous topic negative pressure of 125mmHg was used. In cases where we used VAC ULTA system for instillation we applied 0,9% saline solution in clean wounds or Prontosan® (B. Braun, Melsungen, Germany) in infected wounds and where artificial material was involved. The cycle of instillation was set to 25min and negative pressure lasted for 4 to 6 hours. Dressing changes were performed every 48-72 hours. Besides VAC therapy, we manage these patients as follows: a Foley catheter is placed except in patients with urethral injuries where cystostomy is performed. In all patients who experience large perineal tissue loss and have a high risk of contamination, a protective ostomy is performed. The infective load of the colon and rectum is reduced with rectal washout and anal sphincter is evaluated. VAC therapy is started immediately after necrectomy and ostomy are performed. VAC and dressing changes are performed under sterile conditions in the operating room once every 2-3 days. Special care is taken to protect the nearby skin. In perineal region we always applied continuous topical negative pressure of 125-mmHg to the treated area. VAC application was continued until the wound was closed with delayed primary closure, by split thickness grafts or free flap performed by plastic surgeon.

Report of four cases

Case 1

A 45-year-old female, who was injured in mass traffic accident, presented at the emergency room with traumatic hemipelvectomy and hemorrhagic shock. Hemodynamically unstable

patient was after resuscitation submitted to a damage control procedure in the operating room (OR) where she underwent haemostasis with sutures of external iliac vessels and emergency debridement of the necrotic skin, subcutaneous tissues and lose bone fragments were removed. We used VAC black sponge and continuous topical negative pressure of 175mmHg was applied. Afterwards she was transferred to the ICU and topical negative pressure was after 3 hours

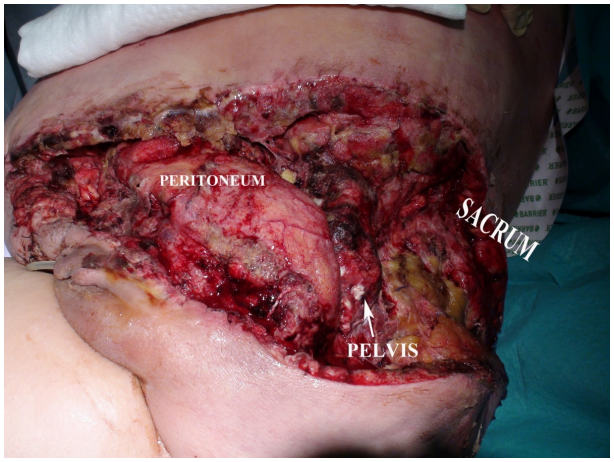

Figure 1. The patient after debridement on postoperative day 2 after traumatic hemipelvectomy

Figure 2. VAC dressing was changed in ICU on postoperative day 6

lowered to 125mmHg. The patient underwent repeated exploration and debridement (Figure 1) of the wound in OR under general anesthesia on day two and four. On day six, VAC dressing was changed in ICU (Figure 2). Bacterial samples were collected from the wound during the reoperations and dressing change. According to the bacterial clearance the wound was free of bacterial growth after the sixth day. Patient was transferred to department of plastic and reconstructive surgery where defect was covered with free flap. Patient was soon after the last procedure transferred to her nativecountry (Italy) and was not available for a follow-up.

Case 2

A 65-year old obese woman with type 2 diabetes and arterial hypertension presented to the abdominal outpatient department with a 1-day history of increasing left hip and suprapubic pain. She had a past history of abdominoplasty 10-years prior to this admission. On examination, the patient was dehydrated and body temperature was elevated (38.9°C). Her blood pressure was 90/56

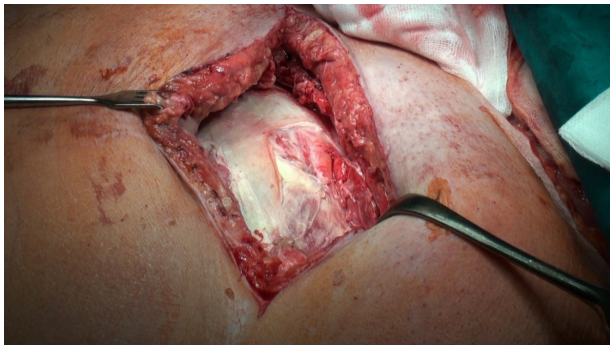

Figure 3. Patient with necrotising fasciitis who underwent emergency debridement of the necrotic skin and subcutaneous tissues with drainage of pus

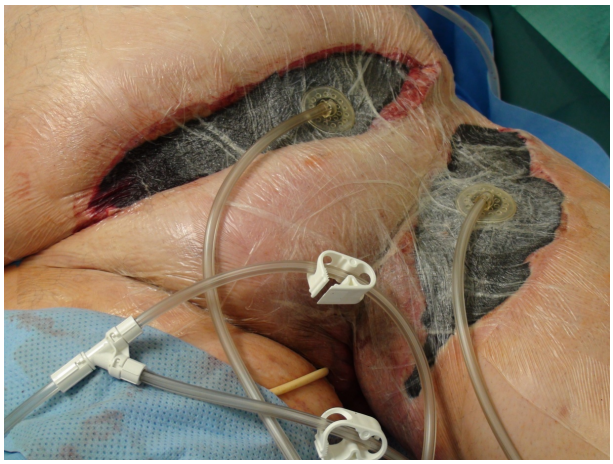

Figure 4. VAC was applied on the wounds of abdominal wall and left inner thigh toward the perineum. Under the skin, bridge foams of both areas communicated

mmHg and pulse rate was 116/min. Abdomi-nal examination revealed deep suprapubic tender-ness with erythema of the perineum and inner thighs. Bowel sounds were normal. Initial haema-tological investigations demonstrated a haemo-globin level of 128g/l, white cell count of 25.1×109/litre, erythrocyte sedimentation rate of 109mm/hour and a C-reactive protein of 569mg/L. She was admitted to the ICU and treated with analgesia, fluid resuscitation and intravenous antibiotics benzyl-penicillin (3g), clindamycin (900mg), ciprofloxacin (400mg) which were administered 3 times per day. An emergency CT scan was performed and revealed extensive oedema of abdominal wall bellow the scar of abdominoplasty, urethra, vagina and rectum with fluid collections within the proximal thigh adductors on the left side which contained an air/fluidlevel. Surgical assessment identified extensive abdominal wall and inner thigh cellulitis suspicious of necrotising fasciitis. She underwent emergency debridement of the necrotic skin and subcutaneous tissues with drainage of pus (Figure3). Gram staining confirmed gram-positive cocci extending from the surface of the skin into the deep fatty tissue, suggestive of streptococcal necrotising fasciitis. Cultures of swabs taken from the perineal wound isolated streptococci, enterococci and mixed

anaerobes. VAC was applied on the wounds of abdominal wall and inner thigh left toward the perineum. Femoral vessels were covered with silicon mesh and white foam. Under the skin, bridge foams of both areas communicated (Figure4). Post-operatively, she was transferred to the ICU for inotropic support. The patient underwent repeated exploration, debride-ment of the wound and VAC dressing application in OR under general anaesthesia on postoperative days 2,4,6. On days 9,12,15 we performed dres-sing changes. On the 20th postoperative day, partial skin grafts obtained from the antero-lateral aspect of the right thigh were applied to the abdominal and thigh wounds. The VAC system was then applied over the skin graft at a lower topical negative pressure of 50mmHg. The patient was discharged on the 29th postoperative day. She remained well 18-months after discharge, but she was not available for a follow-up in last three years.

Case 3

A 55-year-old male patient was admitted with a perianal gluteal abscess followed by a spread of the infection to the swollen, edematous, emphysematous scrotum. Surgical debridement and fasciotomy were performed after admission. The infection was caused by aerobic and anaerobic organisms. On the basis of the microbiological culture, the patient was given multiple antibiotic therapies. After ten days, the exudate was not completely controlled with modern dressing changes and negative pressure wound therapy was started. VAC was applied on the surface of the scrotal and gluteal area and continued for 10 days, with dressing changes every 3 days. Treatment was effective, granulation tissue appeared and the patient did not require reconstructive surgery and skin grafting. Secondary skin closure was done 20 days after admission.

Case 4

A 58-year-old female patient underwent a TVT (tension-free vaginal tape) procedure. Three years after procedure she was admitted with severe gluteal and elbow pain, and suppurative exudates from her vaginal area. Her evaluation was consistent with a diagnosis of necrotizing fasciitis and she was started on multiple antibiotics and taken to urgent surgery for exploration, TVT removal and debridement. At first, we started with alginate dressing changes every day, and on daily basis reevaluated surgical wounds for potential surgical revision. The exudate from treated wound was extensive (Figure5). After 10 days we started treatment with negative pressure with instillation (VAC Ulta) (Figure6). Instillation cycle with saline solution was performed every 6 hours. After 20 days, wounds were clean and granulation tissue was seen on wound bed (Figure7). We started with the gradual approximation of the edges of the wound with staples (Figure8). Skin defect was covered with split-thickness skin graft (Figure9) and fixed with polyvinyl alcohol dressing under NPWT for the next 6 days. Patient was dismissed from hospital after 70 days without neurological or motoric symptoms, although sciatic nerve was completely exposed in the wound bed.

Fig. 5 A 58-year-old female with necrotizing fasciitis on 10th postoperative day after unsuccessful conservative wound treatment with alginate

Fig. 6 After 10 days we started treatment with negative pressure with instillation (VAC Ulta). Because of exposure of sciatic nerve in the wound V.A.C. VeraFlo Cleanse™ dressing was used

Fig. 7 After 20 days of therapy with negative pressure and instillation (VAC Ulta), wounds were clean and granulation tissue was seen on wound bed.

Fig 8. Result of treatment with VAC on the lateral side, before coverage with split-thickness graft

Fig 9. Final result after 46 days of VAC application with split thickness grafting on medial side of the same leg as in Fig. 8.

Discussion

The In this case study, VAC treatment was found to be effective in managing different clinical problems in perineum and surrounding areas. VAC has been used with great success to care for a variety of wounds. VAC involves the application of foam to a wound, adding a seal of adhesive drape, and then applying sub-atmospheric pressure to the wound in a controlled way (11). Our patients were more comfortable with VAC treatment and VAC healed the wounds with fewer interventions than with conventional wound care. Level of comfort and also mobility of the patients was substantially increased, because the system is portable and patients are not confined to their beds. VAC patients could be bathed and there is no bad odour from the wound. Thus, a marked increase in quality of life was observed when VAC was used compared to conventional treatment. In addition, nurses and most physicians preferred it to conventional dressings because of the effectiveness of VAC treatment and time savings. This treatment was found to be similar in cost to conventional treatment. One of the adverse effects associated with VAC therapy is pain. With the use of VAC ULTA we can decrease discomfort with addition of local anaesthetics like Xylocaine in installation fluid before dressing change. However, the pain is more related to the nature of the wounds treated by VAC rather than to VAC itself. Several factors affect the healing of perineal wounds. In addition to ensuring appropriate debridement, adequate nutrition, urine, stool and gas passage and prevention of excessive pressure, the healing of wounds in the perineum present multiple challenges. Because of anatomic conditions it is difficult to secure dressing air tightly, risk of infection is higher because of faecal and urinary flow and immobilization of the patient is often necessary.

To get a seal around the wound or tubing is mandatory. Modelling drapes in smaller stripes and careful application on dry skin wiped with acetone helps in this situation. If additional sealant is needed to maintain a seal, the application of a stoma adhesive paste around drains and at leak sites is useful. Urinary catheter or cystostomy diverts urinary flow. Loop ileostomy on the right side is preferred when treatment is expected to be finished in one month and when wounds are extending to the left side of the body. Colostomy is preferred by authors when long treatment and extensive reconstruction procedures are anticipated or anal region is involved. In some cases, the use of temporary containment device that consists of a silicone catheter, syringe, and collection bag (Flexi-Seal FMS, Convatec, Princeton, NJ) is indicated. The main contraindication to this catheter is injured anus or rectum or very weak sphincter muscles, which may not be able to hold the device in place. Using this system, the stool should be also softened to prevent obstruction of catheter.

Conclusion

The use of VAC system has revolutionized wound healing. By increasing granulation and wound contraction, the VAC promotes earlier wound closure, skin grafting with improved graft adherence and therefore earlier discharge from the hospital. Its use in the perineum presents a challenge, but with proper application and use of modified techniques, it offers an important advance in the treatment of these debilitating and sometimes fatal wounds.

References

1. Roje Z, Roje Z, Matic D, Librenjak D, Dokuzovic S, Varvodic J. Necrotizing fasciitis: literature review of contemporary strategies for diagno sing and management with three case reports: torso, abdominal wall, upper and lower limbs. World J Emerg Surg2011;6(1):46- 51. [CrossRef][PubMed]
2. Schaffzin DM,Douglas JM, Stahl TJ, Smith LE.Vacuum-assisted closure of complex perineal wounds.Dis Colon Rectum 2004; 47(10):1745-8. [CrossRef][PubMed]
3. Hutchinson L, Thompson J. Vacuum-assisted closure: a method of facilitating wound healing. J World Council Enterostomal Therapists 1999; 19:17–21.
4. Smektala R, Hahn MP, Henkel M, Muhr G. Surgical management of complications of open pelvic injuries. Zentralbl Chir 1995; 120:893–8.German. [PubMed]
5. Labler L, Trentz O.The use of vacuum assisted closure (VAC™) in soft tissueinjuries after high energy pelvic trauma. Langenbecks Arch Surg 2007; 392:601–9.[CrossRef][PubMed]
6. Durmishi Y,Gervaz P, Bühler L, Bucher P, Zufferey G, Al-Mazrouei A, et al. Vacuum-assisted abdominal closure: its role in the treatment of complex abdominal and perineal wounds. Experience in 48 patients.J Chir 2007; 144(3):209-13. French. [CrossRef][PubMed]
7. Ozturk E, Ozguc H, Yilmazlar T.The use of vacuum assisted closure therapy in the manage ment of Fournier's gangrene.Am J Surg 2009; 197: 660–5.[CrossRef][PubMed]
8. Fournier JA. Jean-Alfred Fournier 1832-1914. Gangrène foudroyante de la verge (over whelming gangrene). Sem Med 1883.Dis Colon Rectum 1988;31(12):984-8. [PubMed]
9. Pastore AL, Palleschi G, Ripoli A, Silvestri L, Leto A, Autieri D, et al. A multistep approach to manage Fournier's gangrene in a patient with unknown type II diabetes: surgery, hyperbaric oxygen, and vacuum-assisted closure therapy: a case report.J Med Case Rep 2013; 3:7. [CrossRef][PubMed]
10. Stremitzer S, Bachleitner-Hofmann T, Gradl B, Gruenbeck M, Bachleitner-Hofmann B, Mittlboeck M, et al. Mesh Graft Infection Follo wing Abdominal Hernia Repair: Risk Factor Evaluation and Strategies of Mesh Graft Preservation. A Retrospective Analysis of 476 Operations. World J Surg 2010; 34:1702–9. [CrossRef][PubMed]
11. Weinfeld AB, Kelley P, Yuksel E, Tiwari P, Hsu P, Choo J, et al. Circumferential negative pressure dressing (VAC) to bolster skin grafts in the reconstruction of the penile shaft and scrotum. Ann Plast Surg 2005;54:178–83.[CrossRef] [PubMed]